

SEQUENCE LISTING

<110> Singletary, George
Zhou, Lan

<120> Novel Starch Synthase Polynucleotides
and Their Use in the Production of New Starches

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atg	atg	tac	gga	aca	att	cct	gtt	gtg	cat	gca	gta	ggt	ggt	ctt	cga	1877
Met	Met	Tyr	Gly	Thr	Ile	Pro	Val	Val	His	Ala	Val	Gly	Gly	Leu	Arg	
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gat	act	gtg	caa	cag	ttt	gat	ccg	ttc	aat	gag	aca	ggt	ttg	gga	tgg	1925
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Thr	Phe	Asp	Arg	Ala	Glu	Ala	His	Arg	Met	Ile	Val	Ala	Leu	Gly	His	
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Cys	Leu	Asn	Thr	Tyr	Arg	Asn	Tyr	Lys	Glu	Ser	Trp	Val	Gly	Leu	Gln	
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Lys	Arg	Gly	Met	Met	Gln	Asp	Leu	Ser	Trp	Glu	Ser	Ala	Ala	Glu	His	
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Ala Gly Ala Asp Ala Leu Leu Met Pro Ser Arg Phe Glu Pro Cys Gly
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Ile Val Ala Leu Gly His Cys Leu Asn Thr Tyr Arg Asn Tyr Lys Glu
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Ser Trp Val Gly Leu Gln Lys Arg Gly Met Met Gln Asp Leu Ser Trp
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Arg Lys Gly His Leu Val Glu Ile Val Leu Pro Lys Tyr Asp Cys Met	
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Gln Tyr Asp Leu Val Pro Asp Leu Arg Val Leu Asp Val Ala Val Glu	
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Ser Tyr Phe Asp Gly Gln Leu Phe Lys Asn Lys Ile Trp Val Ala Ala	
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Ala Phe Arg Tyr Tyr Thr Lys Ser Pro Lys Asn Trp Gln Asn Leu Val			
485	490	495	
cag aag gtt atg aga atg gac ttc agt tgg gat tct tcg gca tcg caa			2853
Gln Lys Val Met Arg Met Asp Phe Ser Trp Asp Ser Ser Ala Ser Gln			
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<210> 13
 <211> 2176
 <212> DNA
 <213> Canna edulis

<220>
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 aatgacgtga gcatattcca atg gct gct atg acg gca tca cac ttc atc tca 113
 Met Ala Ala Met Thr Ala Ser His Phe Ile Ser
 1 5 10

aat agt tca tgc tcc atc ttc aat gga gct ttt gat tct gtg gtg acg 161
 Asn Ser Ser Cys Ser Ile Phe Asn Gly Ala Phe Asp Ser Val Val Thr
 15 20 25

tct ttc caa agc aga agg att cca ttc tcc agc aac cac act aat aat 209
 Ser Phe Gln Ser Arg Arg Ile Pro Phe Ser Ser Asn His Thr Asn Asn
 30 35 40

tat gaa ggg ctg aga act cgg aat gtg gtg gat tca cgt aaa acg cgg 257
 Tyr Glu Gly Leu Arg Thr Arg Asn Val Val Asp Ser Arg Lys Thr Arg
 45 50 55

atg act gcg aag gca act tct agg cta gct agg agg gtt act cga cat 305
 Met Thr Ala Lys Ala Thr Ser Arg Leu Ala Arg Arg Val Thr Arg His

60	65	70	75	
gcc agc caa aga ccc ttg att gtt gct gtc tgt gga act gga atg aac				353
Ala Ser Gln Arg Pro Leu Ile Val Ala Val Cys Gly Thr Gly Met Asn	80	85	90	
ttg gtg ttt gtt ggt tgt gag gta gct cca tgg agc aaa act ggg ggc				401
Leu Val Phe Val Gly Cys Glu Val Ala Pro Trp Ser Lys Thr Gly Gly	95	100	105	
ctt ggc gat gtt ctt aga gga ttg cca cct gct atg gct gca att ggg				449
Leu Gly Asp Val Leu Arg Gly Leu Pro Pro Ala Met Ala Ala Ile Gly	110	115	120	
cac agg gtc atg acc gtg gtg cca cga tat gac caa tat aaa gat atc				497
His Arg Val Met Thr Val Val Pro Arg Tyr Asp Gln Tyr Lys Asp Ile	125	130	135	
tgg gat aca agt gtc cca gtt gag tta aaa gtt ggg gat aag att gaa				545
Trp Asp Thr Ser Val Pro Val Glu Leu Lys Val Gly Asp Lys Ile Glu	140	145	150	155
act gtc cgc ttc ttc cac tgc tac aaa agg gga gtt gat cgg gtt ttt				593
Thr Val Arg Phe Phe His Cys Tyr Lys Arg Gly Val Asp Arg Val Phe	160	165	170	
gtg gat cac cct atg ttt ctc gag aag gtt tgg ggg aaa aca gga gga				641
Val Asp His Pro Met Phe Leu Glu Lys Val Trp Gly Lys Thr Gly Gly	175	180	185	
aaa tta tat ggt cct gtt aca gga aca gat tat gca gac aat caa cta				689
Lys Leu Tyr Gly Pro Val Thr Gly Thr Asp Tyr Ala Asp Asn Gln Leu	190	195	200	
aga ttc agc ctt ttg tgc ctg gca gct ctg gaa gct cca aga ctt cta				737
Arg Phe Ser Leu Leu Cys Leu Ala Ala Leu Glu Ala Pro Arg Leu Leu	205	210	215	
aat ctc aac aac agc aaa tac tat tct gga cca tat gga gat gat gtt				785
Asn Leu Asn Asn Ser Lys Tyr Tyr Ser Gly Pro Tyr Gly Asp Asp Val	220	225	230	235
gtg ttt att gcc aac gat tgg cat tct gct cta ctg ccc tgc tac ttg				833
Val Phe Ile Ala Asn Asp Trp His Ser Ala Leu Leu Pro Cys Tyr Leu	240	245	250	
aaa act atg tac caa tca cat ggt att tac atg aat gct aag gtt gca				881
Lys Thr Met Tyr Gln Ser His Gly Ile Tyr Met Asn Ala Lys Val Ala	255	260	265	
ttt tgc att cat aat att gct tac cag ggc cga ttt gcc ttt tgc gac				929
Phe Cys Ile His Asn Ile Ala Tyr Gln Gly Arg Phe Ala Phe Ser Asp	270	275	280	
ttt gaa ctc ctt aat ctc ccc aat aaa ttt aaa tct tca ttt gat ttc				977
Phe Glu Leu Leu Asn Leu Pro Asn Lys Phe Lys Ser Ser Phe Asp Phe				

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atg gat gga tat gac	aaa cct gtg aaa gga	agg aaa ata aat tgg atg	1025
Met Asp Gly Tyr Asp	Lys Pro Val Lys Gly	Arg Lys Ile Asn Trp Met	
300	305	310 315	
aag gct gga ata ata	gaa tgt gat agg tgc	ttg acc gtg agc cca tat	1073
Lys Ala Gly Ile Ile	Glu Cys Asp Arg Cys	Leu Thr Val Ser Pro Tyr	
	320	325 330	
tat gcc caa gag ctt gtc	tca ggg gta gag aag	ggg gtt gag ttg ggc	1121
Tyr Ala Gln Glu Leu	Val Ser Gly Val Glu	Lys Gly Val Glu Leu Gly	
	335	340 345	
aat atc ctg cgc atg	aaa acc atc tgt gga	ata gta aat ggg atg gac	1169
Asn Ile Leu Arg Met	Lys Thr Ile Cys Gly	Ile Val Asn Gly Met Asp	
	350	355 360	
acc acg gag tgg aat	cca tta aca gac aaa	tat att tct aca aac tac	1217
Thr Thr Glu Trp Asn	Pro Leu Thr Asp Lys	Tyr Ile Ser Thr Asn Tyr	
	365	370 375	
gat gca aca act gta	ttg gat gca aaa cct	ctc tgt aag gaa gct ttg	1265
Asp Ala Thr Thr Val	Leu Asp Ala Lys Pro	Leu Cys Lys Glu Ala Leu	
	380 385	390 395	
caa gct gag tgt ggg	ctg cct gtt aac aaa	aac aag ctt gtt ttg gcc	1313
Gln Ala Glu Cys Gly	Leu Pro Val Asn Lys	Asn Lys Leu Val Leu Ala	
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ttt gtt gga aga cta	gat gag cag aaa ggc	tca gac att cta gct gca	1361
Phe Val Gly Arg Leu	Asp Glu Gln Lys Gly	Ser Asp Ile Leu Ala Ala	
	415	420 425	
gca att cca gaa ctt	ctt tgt gag aat gtt	caa gtg ata gta ctt ggc	1409
Ala Ile Pro Glu Leu	Leu Cys Glu Asn Val	Gln Val Ile Val Leu Gly	
	430	435 440	
act ggc aag aag aag	ttg gag agt gaa ctt	aca tta ctt gag gaa atg	1457
Thr Gly Lys Lys Lys	Leu Glu Ser Glu Leu	Thr Leu Leu Glu Glu Met	
	445	450 455	
ttt cca gac aaa ttc	aga gca cat ctc aaa	ttc aac gtt cct tta gct	1505
Phe Pro Asp Lys Phe	Arg Ala His Leu Lys	Phe Asn Val Pro Leu Ala	
	460 465	470 475	
cat gca atc atg gca	gga gct gat atc ctt	gtt att cca agc aga ttc	1553
His Ala Ile Met Ala	Gly Ala Asp Ile Leu	Val Ile Pro Ser Arg Phe	
	480	485 490	
gaa ccc tgt ggc ctc	att cag ctt cag gcc	atg cga tat gga act ctc	1601
Glu Pro Cys Gly Leu	Ile Gln Leu Gln Ala	Met Arg Tyr Gly Thr Leu	
	495	500 505	
cct atg tgt agc acc	act ggt gga ctt gtt	gac act gtc aaa gaa ggc	1649
Pro Met Cys Ser Thr	Thr Gly Gly Leu Val	Asp Thr Val Lys Glu Gly	

510	515	520	
ttc act ggc ttc cat atg ggc ccc ttc agt gtg gag tgt gat gcc gta			1697
Phe Thr Gly Phe His Met Gly Pro Phe Ser Val Glu Cys Asp Ala Val			
525	530	535	
gac aaa gct gat gta caa aag att gtc gaa acc acg aaa agg gcc ctc			1745
Asp Lys Ala Asp Val Gln Lys Ile Val Glu Thr Thr Lys Arg Ala Leu			
540	545	550	555
aaa gtc tat gga aca cct gct ttt gtg gag atg atc aag aac tgc atg			1793
Lys Val Tyr Gly Thr Pro Ala Phe Val Glu Met Ile Lys Asn Cys Met			
	560	565	570
aac caa gat ctc tca tgg aag gga cct gca aag aag tgg gaa caa ttt			1841
Asn Gln Asp Leu Ser Trp Lys Gly Pro Ala Lys Lys Trp Glu Gln Phe			
	575	580	585
ctc ctg agc atg ggg gct gct ggc agt gaa cct gga att gat ggg gag			1889
Leu Leu Ser Met Gly Ala Ala Gly Ser Glu Pro Gly Ile Asp Gly Glu			
	590	595	600
gaa ata gct cct ctt gcc aag gaa aat gta gct act cca tgagagatga			1938
Glu Ile Ala Pro Leu Ala Lys Glu Asn Val Ala Thr Pro			
	605	610	615
ctaatactttt cctctttagt catagtccta agccttggtg taaagataaa taatcatcct			1998
ccaaaacctc catcgacatg atgtatcctt cacgagcttg gataaattcc aagagttttt			2058
atataagcag ttatgtagtc gtcaatctgt atggaaaatc cgtcaatgaa atttttttat			2118
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 <213> Canna edulis

<400> 14

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Arg	Ile	Pro	Phe	Ser	Ser	Asn	His	Thr	Asn	Asn	Tyr	Glu	Gly	Leu	Arg
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Thr	Arg	Asn	Val	Val	Asp	Ser	Arg	Lys	Thr	Arg	Met	Thr	Ala	Lys	Ala
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Thr	Ser	Arg	Leu	Ala	Arg	Arg	Val	Thr	Arg	His	Ala	Ser	Gln	Arg	Pro
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Leu	Ile	Val	Ala	Val	Cys	Gly	Thr	Gly	Met	Asn	Leu	Val	Phe	Val	Gly
			85					90						95	
Cys	Glu	Val	Ala	Pro	Trp	Ser	Lys	Thr	Gly	Gly	Leu	Gly	Asp	Val	Leu
		100						105					110		
Arg	Gly	Leu	Pro	Pro	Ala	Met	Ala	Ala	Ile	Gly	His	Arg	Val	Met	Thr
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Val	Val	Pro	Arg	Tyr	Asp	Gln	Tyr	Lys	Asp	Ile	Trp	Asp	Thr	Ser	Val
		130				135					140				
Pro	Val	Glu	Leu	Lys	Val	Gly	Asp	Lys	Ile	Glu	Thr	Val	Arg	Phe	Phe

145					150					155				160
His	Cys	Tyr	Lys	Arg	Gly	Val	Asp	Arg	Val	Phe	Val	Asp	His	Pro Met
				165					170					175
Phe	Leu	Glu	Lys	Val	Trp	Gly	Lys	Thr	Gly	Gly	Lys	Leu	Tyr	Gly Pro
			180					185					190	
Val	Thr	Gly	Thr	Asp	Tyr	Ala	Asp	Asn	Gln	Leu	Arg	Phe	Ser	Leu Leu
		195					200					205		
Cys	Leu	Ala	Ala	Leu	Glu	Ala	Pro	Arg	Leu	Leu	Asn	Leu	Asn	Asn Ser
	210					215					220			
Lys	Tyr	Tyr	Ser	Gly	Pro	Tyr	Gly	Asp	Asp	Val	Val	Phe	Ile	Ala Asn
225					230					235				240
Asp	Trp	His	Ser	Ala	Leu	Leu	Pro	Cys	Tyr	Leu	Lys	Thr	Met	Tyr Gln
			245					250						255
Ser	His	Gly	Ile	Tyr	Met	Asn	Ala	Lys	Val	Ala	Phe	Cys	Ile	His Asn
		260					265						270	
Ile	Ala	Tyr	Gln	Gly	Arg	Phe	Ala	Phe	Ser	Asp	Phe	Glu	Leu	Leu Asn
	275					280						285		
Leu	Pro	Asn	Lys	Phe	Lys	Ser	Ser	Phe	Asp	Phe	Met	Asp	Gly	Tyr Asp
	290					295					300			
Lys	Pro	Val	Lys	Gly	Arg	Lys	Ile	Asn	Trp	Met	Lys	Ala	Gly	Ile Ile
305					310					315				320
Glu	Cys	Asp	Arg	Cys	Leu	Thr	Val	Ser	Pro	Tyr	Tyr	Ala	Gln	Glu Leu
			325					330					335	
Val	Ser	Gly	Val	Glu	Lys	Gly	Val	Glu	Leu	Gly	Asn	Ile	Leu	Arg Met
		340					345					350		
Lys	Thr	Ile	Cys	Gly	Ile	Val	Asn	Gly	Met	Asp	Thr	Thr	Glu	Trp Asn
	355					360					365			
Pro	Leu	Thr	Asp	Lys	Tyr	Ile	Ser	Thr	Asn	Tyr	Asp	Ala	Thr	Thr Val
	370					375					380			
Leu	Asp	Ala	Lys	Pro	Leu	Cys	Lys	Glu	Ala	Leu	Gln	Ala	Glu	Cys Gly
385					390					395				400
Leu	Pro	Val	Asn	Lys	Asn	Lys	Leu	Val	Leu	Ala	Phe	Val	Gly	Arg Leu
			405					410					415	
Asp	Glu	Gln	Lys	Gly	Ser	Asp	Ile	Leu	Ala	Ala	Ala	Ile	Pro	Glu Leu
		420					425					430		
Leu	Cys	Glu	Asn	Val	Gln	Val	Ile	Val	Leu	Gly	Thr	Gly	Lys	Lys Lys
	435					440					445			
Leu	Glu	Ser	Glu	Leu	Thr	Leu	Leu	Glu	Glu	Met	Phe	Pro	Asp	Lys Phe
	450				455					460				
Arg	Ala	His	Leu	Lys	Phe	Asn	Val	Pro	Leu	Ala	His	Ala	Ile	Met Ala
465					470				475					480
Gly	Ala	Asp	Ile	Leu	Val	Ile	Pro	Ser	Arg	Phe	Glu	Pro	Cys	Gly Leu
			485					490					495	
Ile	Gln	Leu	Gln	Ala	Met	Arg	Tyr	Gly	Thr	Leu	Pro	Met	Cys	Ser Thr
	500						505					510		
Thr	Gly	Gly	Leu	Val	Asp	Thr	Val	Lys	Glu	Gly	Phe	Thr	Gly	Phe His
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Met	Gly	Pro	Phe	Ser	Val	Glu	Cys	Asp	Ala	Val	Asp	Lys	Ala	Asp Val
	530					535				540				
Gln	Lys	Ile	Val	Glu	Thr	Lys	Arg	Ala	Leu	Lys	Val	Tyr	Gly	Thr
545				550				555						560
Pro	Ala	Phe	Val	Glu	Met	Ile	Lys	Asn	Cys	Met	Asn	Gln	Asp	Leu Ser
			565					570					575	
Trp	Lys	Gly	Pro	Ala	Lys	Lys	Trp	Glu	Gln	Phe	Leu	Leu	Ser	Met Gly
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Ala	Ala	Gly	Ser	Glu	Pro	Gly	Ile	Asp	Gly	Glu	Glu	Ile	Ala	Pro Leu

Val	Ile	Cys	Gly	Lys	Gly	Met	Asn	Leu	Val	Phe	Val	Gly	Ala	Glu	Met		
			85					90					95				
gct	cca	tgg	agc	aag	act	gga	ggc	ctt	ggt	gat	ggt	ctt	gga	gga	ctc	453	
Ala	Pro	Trp	Ser	Lys	Thr	Gly	Gly	Leu	Gly	Asp	Val	Leu	Gly	Gly	Leu		
		100					105					110					
cca	ccg	gca	ttg	gcg	gca	aat	gga	cat	cga	ggt	atg	ggt	ata	gcg	cca	501	
Pro	Pro	Ala	Leu	Ala	Ala	Asn	Gly	His	Arg	Val	Met	Val	Ile	Ala	Pro		
		115				120					125						
cgt	tat	gat	caa	tac	atg	gat	gct	tgg	gat	aca	gat	gct	ctt	ggt	gag	549	
Arg	Tyr	Asp	Gln	Tyr	Met	Asp	Ala	Trp	Asp	Thr	Asp	Ala	Leu	Val	Glu		
130					135					140					145		
ttg	aaa	ggt	ggg	gat	agg	tgt	gaa	acc	gtg	cgc	ttc	ttt	cac	tgc	tat	597	
Leu	Lys	Val	Gly	Asp	Arg	Cys	Glu	Thr	Val	Arg	Phe	Phe	His	Cys	Tyr		
				150					155					160			
aaa	aga	gga	ggt	gat	cga	ggt	ttt	gtc	gat	cac	cct	atg	ttt	ctt	gcg	645	
Lys	Arg	Gly	Val	Asp	Arg	Val	Phe	Val	Asp	His	Pro	Met	Phe	Leu	Ala		
			165					170					175				
aag	gtc	tgg	ggg	aaa	act	ggt	ggg	aag	att	tat	ggt	cct	aac	act	gga	693	
Lys	Val	Trp	Gly	Lys	Thr	Gly	Gly	Lys	Ile	Tyr	Gly	Pro	Asn	Thr	Gly		
		180					185					190					
aca	gac	tat	cag	gac	aat	cag	cta	cgc	ttc	agc	ttt	cta	tgc	cag	gca	741	
Thr	Asp	Tyr	Gln	Asp	Asn	Gln	Leu	Arg	Phe	Ser	Phe	Leu	Cys	Gln	Ala		
		195				200					205						
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				230					235					240			
act	tct	ctt	ctg	cca	tgc	tac	tta	aag	agc	atg	tac	cat	ccc	cgt	ggc	885	
Thr	Ser	Leu	Leu	Pro	Cys	Tyr	Leu	Lys	Ser	Met	Tyr	His	Pro	Arg	Gly		
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Ile	Tyr	Lys	Asn	Ala	Lys	Val	Ala	Phe	Cys	Ile	His	Asn	Ile	Ser	Tyr		
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caa	ggt	cga	ttt	tct	ccc	tca	gac	ttc	gaa	ttt	ctc	aat	ctt	ccg	gag	981	
Gln	Gly	Arg	Phe	Ser	Pro	Ser	Asp	Phe	Glu	Phe	Leu	Asn	Leu	Pro	Glu		
		275				280					285						
aat	ttc	aaa	tct	tct	ttc	agt	ttc	att	gat	ggg	tac	aac	aag	cct	gtg	1029	
Asn	Phe	Lys	Ser	Ser	Phe	Ser	Phe	Ile	Asp	Gly	Tyr	Asn	Lys	Pro	Val		
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Lys Gly Met Lys Ile Asn Trp Met Lys Ala Gly Ile Leu Glu Ser Asp	
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Arg Val Phe Thr Val Ser Pro Tyr Tyr Ala Gln Glu Leu Leu Ser Gly	
325 330 335	
gaa gaa agg gga gtc gag ttg gac aac att ttg cgt gtg acc agt atc	1173
Glu Glu Arg Gly Val Glu Leu Asp Asn Ile Leu Arg Val Thr Ser Ile	
340 345 350	
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Asp Lys Tyr Ile Ser Val Asn Tyr Asp Ala Lys Pro Val Met Glu Ala	
370 375 380 385	
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Lys Pro Leu Asn Lys Glu Ala Leu Gln Ala Glu Ser Trp Leu Ala Cys	
390 395 400	
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Arg Gln Gly His Pro Cys Asn Cys Ile His Gly Arg Leu Glu Glu Gln	
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aaa gga tca gat att cta gca gca tcc att cca gag atc atg gat gag	1413
Lys Gly Ser Asp Ile Leu Ala Ala Ser Ile Pro Glu Ile Met Asp Glu	
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Asn Val Gln Leu Ile Ile Leu Gly Thr Gly Lys Lys Glu Met Glu Asn	
435 440 445	
cag ctt gag agt atg gag gaa atg ttc ccg gac aag gtg agg gca gtt	1509
Gln Leu Glu Ser Met Glu Glu Met Phe Pro Asp Lys Val Arg Ala Val	
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Met Lys Phe Asn Ala Pro Leu Ala His Gln Met Thr Ala Gly Ala Asp	
470 475 480	
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Ile Ile Val Ile Pro Ser Arg Phe Glu Pro Cys Gly Leu Ile Gln Leu	
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Gln Gly Met Gln Tyr Gly Thr Pro Ser Ala Cys Ser Ser Thr Gly Gly	
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Leu Val Asp Thr Val Lys Glu Gly Lys Thr Gly Phe His Met Gly Pro	
515 520 525	
ttc agt gct gaa tgc gaa gtg gtc gat ctt tct gat gta aag aaa gtt	1749

Phe	Ser	Ala	Glu	Cys	Glu	Val	Val	Asp	Leu	Ser	Asp	Val	Lys	Lys	Val		
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Val	Thr	Thr	Val	Lys	Arg	Ala	Leu	Lys	Val	Ile	Gly	Thr	Pro	Ala	Phe		
				550					555					560			
gag	gat	atg	atc	aag	aat	tgc	atg	gca	caa	gac	ctc	tca	tgg	aag	ggg	1845	
Glu	Asp	Met	Ile	Lys	Asn	Cys	Met	Ala	Gln	Asp	Leu	Ser	Trp	Lys	Gly		
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cct	gca	aag	aac	tgg	gag	caa	gtt	cta	ctg	aac	ttg	gga	gtt	gcg	gga	1893	
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Ser	Glu	Pro	Gly	Tyr	Asp	Gly	Glu	Glu	Ile	Val	Pro	Leu	Ala	Lys	Glu		
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Asn	Val	Ala	Thr	Pro													
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<210> 18

<211> 614

<212> PRT

<213> Typha latifolia

<400> 18

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			20					25					30				
Asp	Leu	Lys	Asn	Gln	Ala	Thr	Ala	Tyr	His	Gly	Leu	Arg	Ser	Gln	Asn		
			35				40					45					
Ser	Val	Asp	Leu	Leu	Gln	Val	Arg	Thr	Lys	Ala	Lys	Thr	Thr	Ser	Lys		
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Leu	Pro	Pro	Ala	Leu	Ala	Ala	Asn	Gly	His	Arg	Val	Met	Val	Ile	Ala		
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Pro	Arg	Tyr	Asp	Gln	Tyr	Met	Asp	Ala	Trp	Asp	Thr	Asp	Ala	Leu	Val		
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 Arg Leu Asn Thr Lys Ser Thr Pro Lys Val Gly Ser Ser Val Val Ala
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 Pro Thr Val Glu Thr Thr Gly Met Asn Leu Val Phe Val Gly Thr Glu
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 Thr Gly Pro Tyr Ser Lys Thr Gly Gly Leu Gly Asp Val Leu Gly Gly
 85 90 95

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Leu Pro Pro Ala Leu Ala Ala Arg Gly His Arg Val Met Val Val Thr	
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Pro Arg Tyr Asp Gln Tyr Lys Asp Ala Trp Asp Thr Asn Thr Val Leu	
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Glu Ile Lys Val Gly Asp Lys Met Glu Thr Val Arg Phe Phe His Leu	
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cat aag agg ggg gtg gat agg gtg ttt att gat cac cct tgg ttt ctt	540
His Lys Arg Gly Val Asp Arg Val Phe Ile Asp His Pro Trp Phe Leu	
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Glu Lys Val Trp Gly Lys Thr Gly Gly Lys Leu Tyr Gly Pro Val Thr	
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Phe Ser Gly Pro Tyr Gly Glu Asp Val Val Phe Ile Ala Asn Asp Trp	
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230 235 240	
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Tyr Gln Gly Arg Phe Ala Phe Pro Asp Phe Ser Leu Leu Asn Leu Pro	
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Val Lys Gly Arg Lys Ile Asn Trp Met Lys Ala Gly Ile Leu Glu Ala	
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Glu Asn Val Gln Ile Ile Ile Leu Gly Thr Gly Lys Lys His Leu Glu	
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Lys Glu Leu Glu Glu Ile Glu Glu Gln Phe Pro Asp Lys Met Arg Leu	
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Leu Glu Gly Met Lys Tyr Gly Met Pro Ala Ile Cys Ser Thr Thr Gly	
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Ala Phe Thr Val Glu Cys Glu Thr Val Asp Pro Val Asp Val Ala Gly	
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Ile Val Lys Thr Val Lys Arg Ala Leu Lys Val Tyr Gly Thr Pro Ala	
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Glu	Thr	Gly	Pro	Tyr	Ser	Lys	Thr	Gly	Gly	Leu	Gly	Asp	Val	Leu	Gly
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Gly	Leu	Pro	Pro	Ala	Leu	Ala	Ala	Arg	Gly	His	Arg	Val	Met	Val	Val
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Thr	Pro	Arg	Tyr	Asp	Gln	Tyr	Lys	Asp	Ala	Trp	Asp	Thr	Asn	Thr	Val
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Leu	Glu	Ile	Lys	Val	Gly	Asp	Lys	Met	Glu	Thr	Val	Arg	Phe	Phe	His
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Leu	His	Lys	Arg	Gly	Val	Asp	Arg	Val	Phe	Ile	Asp	His	Pro	Trp	Phe
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Leu	Glu	Lys	Val	Trp	Gly	Lys	Thr	Gly	Gly	Lys	Leu	Tyr	Gly	Pro	Val
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Thr	Gly	Thr	Asp	Tyr	Asp	Asp	Asn	Gln	Leu	Arg	Phe	Ser	Leu	Leu	Cys
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Gln	Ala	Ala	Leu	Glu	Ala	Pro	Arg	Val	Leu	Asn	Leu	Asn	Asn	Ser	Lys
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Ser	Gly	Glu	Asp	Arg	Gly	Val	Glu	Leu	Asp	Asn	Val	Leu	Arg	Leu	Arg	
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Gly	Val	Lys	Gly	Ile	Val	Asn	Gly	Met	Asp	Thr	Asn	Val	Trp	Asn	Pro	
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Leu	Thr	Asp	Lys	Phe	Ile	Thr	Ala	Asn	Tyr	Asp	Ala	Thr	Met	Val	Thr	
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Glu	Gln	Lys	Gly	Ser	Asp	Ile	Leu	Ala	Ala	Ala	Ile	Pro	Glu	Leu	Met	
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Ala	Phe	Ser	Glu	Met	Val	Gln	Asn	Cys	Met	Ala	Gln	Asp	His	Ser	Trp	
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Lys	Glu	Pro	Ala	Lys	Lys	Trp	Glu	Glu	Leu	Leu	Leu	Gly	Leu	Glu	Val	
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Gly Glu Glu Arg Glu Gly Val Gly Arg Ala Gly Val Gly Asp Asp Ala
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Asn Leu Leu Gln Gln Ile Ala Lys Arg Lys Asn Ile Val Ser Ser Ile
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aga agt gac gta act aag gaa gaa aat gat tca agt tct tat gtt gag 288
Arg Ser Asp Val Thr Lys Glu Glu Asn Asp Ser Ser Ser Tyr Val Glu
85 90 95

aag gaa aat ttg gag cca agc agt gga gag caa aat ggg aag tac aaa 336
Lys Glu Asn Leu Glu Pro Ser Ser Gly Glu Gln Asn Gly Lys Tyr Lys
100 105 110

agc ggc gcc gtt cct aat aat tat tcc caa ttg gct caa gat gat aca 384
Ser Gly Ala Val Pro Asn Asn Tyr Ser Gln Leu Ala Gln Asp Asp Thr
115 120 125

tct gag aat cca ctt gtt aat tcc ttt gga ggt tct cca aaa gat aac 432
Ser Glu Asn Pro Leu Val Asn Ser Phe Gly Gly Ser Pro Lys Asp Asn
130 135 140

gta gaa gct gtt gaa ttt cag gtg aga caa tca gca gta gat gct ttt 480
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Phe Tyr Leu Glu Ala Glu Ser Asp Gly Ala Lys Glu Glu Asn Ala Glu	
180 185 190	
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Asp Leu Val Glu Ala Lys Leu Asp Ser Val His Val Lys Asp Asp Leu	
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His Gly Tyr Ala Trp Glu Leu Lys Thr Ser Glu Gly Gly Trp Gly Leu	
450 455 460	
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Gly Ile Asp Ala Lys Glu Trp Ser Pro Glu Phe Asp Val His Leu Lys	
485 490 495	
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500 505 510	
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Pro Val Cys Lys Ala Ala Leu Gln Arg Glu Val Gly Leu Pro Val Arg	
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Leu Arg Asn Phe Glu Gly Gln His Arg Asp Lys Val Arg Ala Trp Val	
580 585 590	
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595 600 605	

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Ala Met Met Tyr Gly Thr Ile Pro Val Val His Ala Val Gly Gly Leu	
625 630 635 640	
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Arg Asp Thr Val Thr Gln Phe Asp Pro Phe Asn Glu Ser Gly Leu Gly	
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720 725 730 735	
gtc tat atg tga gat cat agt ttc aga tat gcg gca gca tgc aaa tag	2256
Val Tyr Met * Asp His Ser Phe Arg Tyr Ala Ala Ala Cys Lys *	
740 745	
atg aaa ttt ttt tgg ctc atg ctg gaa cat gta aat tgt ttc tct ttt	2304
Met Lys Phe Phe Trp Leu Met Leu Glu His Val Asn Cys Phe Ser Phe	
750 755 760 765	
ttt cca ttt ttg ccc tgc act ctg tac aga gga agg agg aaa caa ttg	2352
Phe Pro Phe Leu Pro Cys Thr Leu Tyr Arg Gly Arg Arg Lys Gln Leu	
770 775 780	
ctg aaa act gtg gag gtc tgt gta ccc tat att tct agc ttt tat taa	2400
Leu Lys Thr Val Glu Val Cys Val Pro Tyr Ile Ser Ser Phe Tyr *	
785 790 795	
tgc aag tag ttc ttc gtt	2418
Cys Lys * Phe Phe Val	
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<212> PRT

<213> *Typha latifolia*

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Gly	Glu	Glu	Arg	Glu	Gly	Val	Gly	Arg	Ala	Gly	Val	Gly	Asp	Asp	Ala
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	50				55						60				
Asn	Leu	Leu	Gln	Gln	Ile	Ala	Lys	Arg	Lys	Asn	Ile	Val	Ser	Ser	Ile
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Arg	Ser	Asp	Val	Thr	Lys	Glu	Glu	Asn	Asp	Ser	Ser	Ser	Tyr	Val	Glu
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Lys	Glu	Asn	Leu	Glu	Pro	Ser	Ser	Gly	Glu	Gln	Asn	Gly	Lys	Tyr	Lys
			100					105					110		
Ser	Gly	Ala	Val	Pro	Asn	Asn	Tyr	Ser	Gln	Leu	Ala	Gln	Asp	Asp	Thr
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Ser	Glu	Asn	Pro	Leu	Val	Asn	Ser	Phe	Gly	Gly	Ser	Pro	Lys	Asp	Asn
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Val	Glu	Ala	Val	Glu	Phe	Gln	Val	Arg	Gln	Ser	Ala	Val	Asp	Ala	Phe
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Gly	Arg	Pro	Glu	Glu	Pro	Ser	Leu	Gly	Thr	Thr	Lys	Ile	Leu	Ser	Pro
			165					170						175	
Phe	Tyr	Leu	Glu	Ala	Glu	Ser	Asp	Gly	Ala	Lys	Glu	Glu	Asn	Ala	Glu
		180						185					190		
Asp	Leu	Val	Glu	Ala	Lys	Leu	Asp	Ser	Val	His	Val	Lys	Asp	Asp	Leu
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Asn	Pro	Gly	Glu	Glu	Asn	Glu	Val	Pro	Leu	Pro	Leu	Ala	Gly	Ala	Asn
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Val	Met	Asn	Ile	Ile	Val	Val	Ala	Ala	Glu	Cys	Ala	Pro	Trp	Ser	Lys
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Thr	Gly	Gly	Leu	Gly	Asp	Val	Ala	Gly	Ala	Leu	Pro	Lys	Ala	Leu	Ala
			245					250						255	
Arg	Arg	Gly	His	Arg	Val	Met	Val	Val	Ala	Pro	Arg	Tyr	Gly	Asn	Tyr
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Ala	Glu	Pro	Gln	Asp	Ile	Gly	Val	Arg	Lys	Tyr	Tyr	Lys	Val	His	Gly
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Gln	Asp	Met	Glu	Val	Thr	Tyr	Phe	His	Ala	Tyr	Ile	Asp	Gly	Val	Asp
	290					295					300				
Phe	Val	Phe	Met	Asp	Ser	Pro	Asp	Phe	Arg	His	Arg	Gly	Asn	Arg	Ile
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Tyr	Glu	Gly	Asn	Arg	Val	Asp	Ile	Leu	Lys	Arg	Met	Ile	Leu	Phe	Cys
			325						330				335		
Lys	Ala	Ala	Val	Glu	Val	Pro	Trp	His	Val	Pro	Cys	Gly	Gly	Phe	Cys
			340					345					350		
Tyr	Gly	Asp	Gly	Asn	Leu	Ala	Phe	Ile	Thr	Asn	Asp	Trp	His	Thr	Ala
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Leu	Leu	Pro	Val	Tyr	Leu	Lys	Ala	Tyr	Tyr	Arg	Asp	Asn	Gly	Leu	Met
	370					375					380				
Lys	Tyr	Ala	Arg	Ser	Val	Leu	Val	Ile	His	Asn	Ile	Ala	His	Gln	Gly
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